BLACKBIRD FOR TRAINING

Advanced Mechanical Systems Integration and Maintenance

10 – 21 January 2027
Cairo (Egypt)

UK Traininig
PARTNER



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Advanced Mechanical Systems Integration and Maintenance

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Introduction

Modern industries demand advanced expertise in mechanical systems integration, operations, and maintenance to ensure efficiency, reliability, and safety. This program is designed for experienced mechanical engineers who are involved in complex mechanical operations and system integration projects.

The training provides an in-depth exploration of advanced topics, including mechanical design, failure analysis, troubleshooting and diagnostics, rotating machinery, hydraulics and pneumatics, heat transfer systems, and energy efficiency. It also emphasizes integration with electrical and control systems, the application of international standards, and the adoption of future technologies.

Through practical workshops, real-world case studies, and group projects, participants will strengthen their technical decision-making and problem-solving skills to excel in modern industrial environments.

Course Objectives

By the end of this course, participants will be able to:

- Understand advanced principles of mechanical systems design and integration.
- Apply systematic troubleshooting and diagnostics to complex mechanical problems.
- Enhance operational efficiency and reliability in mechanical systems.
- Integrate mechanical systems with electrical, hydraulic, pneumatic, and control systems.
- Implement international standards and best practices in mechanical maintenance.
- Apply predictive and condition-based maintenance techniques.
- Improve energy efficiency and sustainability in mechanical operations.

Course Outlines

Day 1: Fundamentals and Review

- Overview of mechanical systems in industrial integration.
- Principles of thermodynamics and fluid mechanics in practice.
- Material selection and mechanical properties.
- Stress, fatigue, and failure analysis.
- Case study: lessons from integration projects.



Day 2: Mechanical Design and Analysis

- Advanced tools for mechanical design and simulation.
- Vibration analysis and damping methods.
- Load calculations and safety margins.
- Design for maintainability and reliability.
- Workshop: analyzing a mechanical system failure.

Day 3: Rotating Machinery

- Principles of pumps, compressors, and turbines.
- Lubrication systems and reliability considerations.
- Alignment and balancing of rotating equipment.
- Fault detection and vibration diagnostics.
- Hands-on session: troubleshooting rotating machinery.

Day 4: Hydraulic and Pneumatic Systems

- Fundamentals of hydraulics and pneumatics.
- Integration with mechanical systems.
- Maintenance strategies for fluid power systems.
- Common issues and troubleshooting methods.
- Practical simulation: hydraulic circuits.

Day 5: Heat Transfer and Thermal Systems

- Heat exchanger types and design considerations.
- Boilers and cooling systems - improving efficiency.
- Thermal insulation materials and applications.
- Energy recovery in mechanical systems.
- Case study: boosting plant energy efficiency.

Day 6: Mechanical Maintenance Strategies

- Preventive vs. predictive maintenance.
- Condition-based monitoring CBM.
- Reliability-centered maintenance RCM.
- Maintenance planning and scheduling.
- Group exercise: designing a maintenance plan.



Day 7: Troubleshooting and Diagnostics

- Systematic troubleshooting methodology.
- Root cause analysis RCA.
- Advanced diagnostic tools and software.
- Failure mode and effects analysis FMEA.
- Workshop: solving complex integration problems.

Day 8: Integration with Electrical and Control Systems

- Mechatronics in modern mechanical engineering.
- PLCs and SCADA in mechanical operations.
- Sensors and instrumentation in mechanical systems.
- Data acquisition and real-time monitoring.
- Case study: integrated plant operation.

Day 9: International Standards and Safety

- ISO standards for mechanical systems and maintenance.
- Risk assessment and hazard identification.
- Occupational health and safety in mechanical plants.
- Emergency preparedness and response.
- Workshop: applying safety standards to a case study.

Day 10: Future Trends and Final Project

- Digital transformation: IoT, AI, and digital twin applications.
- Green technologies and sustainable practices.
- Innovations in materials and manufacturing.
- Group project: integration improvement plan.
- Course review, Q&A, and certification ceremony.

Why Attend this Course: Wins & Losses!

- Gain advanced expertise in mechanical systems integration and maintenance.
- Master troubleshooting and diagnostics for complex mechanical issues.
- Hands-on experience with rotating machinery, hydraulics, pneumatics, and thermal systems.
- Apply international standards ISO and best practices.
- Improve energy efficiency and adopt sustainable approaches.
- Develop skills in predictive and reliability-centered maintenance.
- Learn how to integrate mechanical, electrical, and control systems.
- Build practical strategies for system reliability and performance.



Conclusion

The Advanced Mechanical Systems Integration and Maintenance course provides engineers with comprehensive knowledge and hands-on skills in design, operations, and maintenance of complex systems. Covering everything from mechanical design, failure diagnostics, and rotating equipment to hydraulics, thermal systems, and energy efficiency, this program equips participants to meet modern industrial challenges.

By focusing on international standards, predictive maintenance, and integration with control systems, the course ensures participants are ready to lead advanced projects and optimize performance in high-demand environments.

